

Fuel Oil

1. Diesel Oil

Diesel oil fulfilling:

British Standard MA 100, Class M2; ASTM Classification of Diesel fuel oil D 975, grade No. 4-D; CIMAC grade 1; or similar; may be used.

2. Heavy Oil

Most commercially available fuel oils with a viscosity below 700 cSt. at 50°C (7000 sec. Redwood I at 100°F) can be used.

For guidance on purchase, reference is made to ISO 8217, BS6843 and to CIMAC recommendations regarding requirements for heavy fuel for diesel engines, edition 1990. From these, the maximum accepted grades are RMH 55 and K55. The mentioned ISO and BS standards supersede BS MA 100 in which the limit is M9.

For reference purposes, an extract from relevant standards and specifications is shown in Plate 70501.

The data in the above fuel standards and specifications refer to fuel as delivered to the ship, i.e. before on-board cleaning.

In order to ensure effective and sufficient cleaning of the fuel oil – i.e. removal of water and solid contaminants – the fuel oil specific gravity at 15°C (60°F) should be below 0.991.

Higher densities can be allowed if special treatment systems are installed. See Item 3.1, 'High Density Fuels'.

Current analysis information is not sufficient for estimating the combustion properties of the oil.

This means that service results depend on oil properties which cannot be known beforehand. This especially applies to the tendency of the oil to form deposits in combustion chambers, gas passages and turbines. It may therefore be necessary to rule out some oils that cause difficulties.

If the ship has been out of service for a long time without circulation of fuel oil in the tanks (service and settling), the fuel must be circulated before start of the engine.

Before starting the pump(s) for circulation, the tanks are to be drained for possible water settled during the stop.

The risk of concentration of dirt and water in the fuel to the main and auxiliary engines caused by long time settling is consequently considerably reduced.

For treatment of fuel oil, see further on in this Chapter.

3. Guiding Fuel Oil Specification

Based on our general service experience we have, as a supplement to the above-mentioned standards, drawn up the guiding fuel oil specification shown in the Table below.

Fuel oils limited by this specification have, to the extent of the commercial availability, been used with satisfactory results on MAN B&W two-stroke low speed diesel engines, as well as MAN B&W auxiliary engines.

Guiding specification (maximum values)		
Density at 15°C	kg/m ³	991 *
Kinematic viscosity		
at 100°C	cSt	55
at 50°C	cSt	700
Flash point	°C	≥60
Pour point	°C	30
Carbon residue	%(m/m)	22
Ash	%(m/m)	0.15
Total sediment after ageing	%(m/m)	0.10
Water	%(v/v)	1.0
Sulphur	%(m/m)	5.0
Vanadium	mg/kg	600
Aluminium + Silicon	mg/kg	80
Equal to ISO 8217/CIMAC – H55		

* 1010 provided automatic modern clarifiers are installed.

The data refers to the fuel as supplied, i.e. before any on-board cleaning.

CERTIFICATE

By Authority Of THE UNITED STATES OF AMERICA Legally Binding Document

By the Authority Vested By Part 5 of the United States Code § 552(a) and Part 1 of the Code of Regulations § 51 the attached document has been duly INCORPORATED BY REFERENCE and shall be considered legally binding upon all citizens and residents of the United States of America. HEED THIS NOTICE: Criminal penalties may apply for noncompliance.



Document Name: ASTM D975: Standard Specification for Diesel Fuel Oils

CFR Section(s): 40 CFR 1065.701

Standards Body: American Society for Testing and Materials



Official Incorporator:

THE EXECUTIVE DIRECTOR
OFFICE OF THE FEDERAL REGISTER
WASHINGTON, D.C.

S15, No. 2-D S500, and No. 2-D S5000, Test Method D 56 may be used as an alternate with the same limits, provided the flash point is below 93°C and the viscosity is below 5.5 mm²/s at 40°C. This test method will give slightly lower values. In cases of dispute, Test Methods D 93 shall be used as the referee method. Test Method D 56 can not be used as the alternate method for Grade No. 4-D because its minimum viscosity limit is 5.5 mm²/s at 40°C.

5.1.2 Cloud Point—Test Method D 2500. For all fuel grades in Table 1, the automatic Test Methods D 5771, D 5772, or

D 5773 can be used as alternates with the same limits. Test Method D 3117 can also be used since it is closely related to Test Method D 2500. In case of dispute, Test Method D 2500 shall be the referee method.

5.1.3 Water and Sediment—Test Method D 2709 is used for fuel Grades No. 1-D S15, No. 1-D S500, No. 1-D S5000, No. 2-D S15, No. 2-D S500, and No. 2-D S5000. Test Method D 1796 is used for Grade No. 4-D.

5.1.4 Carbon Residue—Test Method D 524 is used for fuel Grades No. 1-D S15, No. 1-D S500, No. 1-D S5000, No. 2-D

TABLE 1 Detailed Requirements for Diesel Fuel Oils^a

Property	ASTM Test Method ^a	Grade						
		No. 1-D S15	No. 1-D S500 ^c	No. 1-D S5000 ^d	No. 2-D S15	No. 2-D S500 ^{c,e}	No. 2-D S5000 ^{d,e}	No. 4-D ^d
Flash Point, °C, min.	D 83	38	38	38	52 ^f	52 ^f	52 ^f	55
Water and Sediment, % vol, max	D 2709 D 1796	0.05	0.05	0.05	0.05	0.05	0.05	... 0.50
Distillation: one of the following requirements shall be met: 1. Physical Distillation	D 86	...	...	...	...	...	...	...
Distillation Temperature, °C 90 % , % vol recovered								
min		...	...	...	282 ^f	282 ^f	282 ^f	...
max		288	288	288	338	338	338	...
2. Simulated Distillation	D 2887	...	...	...	...	...	...	...
Distillation Temperature, °C 90 % , % vol recovered								
min		...	...	...	...	300 ^f	300 ^f	...
max		...	304	304	...	356	350	...
Kinematic Viscosity, mm ² /S at 40°C	D 445							
min		1.3	1.3	1.3	1.9 ^g	1.9 ^g	1.9 ^g	5.5
max	...	2.4	2.4	2.4	4.1	4.1	4.1	24.0
Ash % mass, max	D 402	0.01	0.01	0.01	0.01	0.01	0.01	0.10
Sulfur, ppm (µg/g) ^h max	D 5453	15	...	...	15	...	...	...
% mass, max	D 2022 ^a	...	0.05	...	...	0.05	...	...
% mass, max	D 129	...	...	0.50	...	...	0.50	2.00
Copper strip corrosion rating max 3 h at 50°C	D 130	No. 3	No. 3	No. 3	No. 3	No. 3	No. 3	...
Cetane number, min ⁱ	D 613	40 ^j	40 ^j	40 ^j	40 ^j	40 ^j	40 ^j	30 ^j
One of the following properties must be met:								
(1) Cetane Index, min.	D 978-80 ^a	40	40	...	40	40	...	...
(2) Aromatics, % vol, max	D 1319 ^a	35	35	...	35	35	...	...
Operability Requirements								
Cloud point, °C, max	D 2500	J	J	J	J	J	J	...
or								
LTFT/CFPP, °C, max	D 4539/ D 6371	...	...	...	...	...	...	...
Ramsbottom carbon residue on 10 % distillation residue, % mass, max	D 524	0.15	0.15	0.15	0.35	0.35	0.35	...
Lubricity, HFRR @ 60°C, micron, max	D 6079	520	520	520	620	620	620	...

^a To meet special operating conditions, modifications of individual limiting requirements may be agreed upon between purchaser, seller, and manufacturer.

^b The test methods indicated are the approved referee methods. Other acceptable methods are indicated in 5.1.

^c Under United States regulations, if Grades No. 1-D S500 or No. 2-D S500 are sold for tax exempt purposes then, at or beyond terminal storage tanks, they are required by 26 CFR Part 48 to contain the dye Solvent Red 184 at a concentration spectrally equivalent to 3.0 lb per thousand barrels of the solid dye standard Solvent Red 26, or the tax must be collected.

^d Under United States regulations, Grades No. 1-D S5000, No. 2-D S5000, and No. 4-D are required by 40 CFR Part 80 to contain a sufficient amount of the dye Solvent Red 184 so its presence is visually apparent. At or beyond terminal storage tanks, they are required by 26 CFR Part 48 to contain the dye Solvent Red 184 at a concentration spectrally equivalent to 3.9 lb per thousand barrels of the solid dye standard Solvent Red 26.

^e When a cloud point less than -12°C is specified, as can occur during cold months, it is permitted and normal blending practice to combine Grades No. 1 and No. 2 to meet the low temperature requirements. In that case, the minimum flash point shall be 38°C, the minimum viscosity at 40°C shall be 1.7 mm²/s, and the minimum 90 % recovered temperature shall be waived.

^f Other sulfur limits can apply in selected areas in the United States and in other countries.

^g These test methods are specified in 40 CFR Part 80.

^h Where cetane number by Test Method D 613 is not available, Test Method D 4737 can be used as an approximation.

ⁱ Low ambient temperatures as well as engine operation at high altitudes may require the use of fuels with higher cetane ratings.

^j It is unrealistic to specify low temperature properties that will ensure satisfactory operation at all ambient conditions. In general, cloud point (or wax appearance point) Low Temperature Flow Test, and Cold Filter Plugging Point Test may be used as an estimate of operating temperature limits for Grades No. 1-D S500; No. 2-D S500; and No. 1-D S5000 and No. 2-D S5000 diesel fuel oils. However, satisfactory operation below the cloud point (or wax appearance point) may be achieved depending on equipment design, operating conditions, and the use of flow-improver additives as described in X5.1.2. Appropriate low temperature operability properties should be agreed upon between the fuel supplier and purchaser for the intended use and expected ambient temperatures. Test Methods D 4539 and D 6371 may be especially useful to estimate vehicle low temperature operability limits when flow improvers are used. Due to fuel delivery system, engine design, and test method differences, low temperature operability tests may not provide the same degree of protection in various vehicle operating classes. Tenth percentile minimum air temperatures for U.S. locations are provided in Appendix X5 as a means of estimating expected regional temperatures. The tenth percentile minimum air temperatures may be used to estimate expected regional target temperatures for use with Test Methods D 2500, D 4539, and D 6371. Refer to X5.1.3 for further general guidance on test application.

MARINE FUEL

BRITISH STANDARDS INSTITUTE SPECIFICATION
FOR PETROLEUM FUELS FOR MARINE OIL ENGINES AND BOILERS

(EXCERPTS FROM BS MA 100 : 1982)

Inspection	Class	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
Density at 15°C, g/ml, max.	—	0.9000	0.9200	0.9910	0.9910	0.9910	0.9910	0.9910	0.9910	0.9910	...	...	...
Viscosity, kinematic at 40°C, cSt, min. max.	1.50 5.50	11.00	14.00	—	—	—	—	—	—	—	—	—	—
Viscosity, kinematic at 80°C, cSt, max.	—	—	—	15.00	25.00	45.00	75.00	100.0	130.0	75.0	100.0	130.0	130.0
Cetane index, min.	45	35	—	—	—	—	—	—	—	—	—	—	—
Carbon residue, Ramsbottom, % (m/m), max.	—	0.25	2.5	...	...	...	...	...	...	...	...	...	...
Carbon residue, Ramsbottom on 10 % residue, % (m/m), max.	0.20	...	—	—	—	—	—	—	—	—	—	—	—
Carbon residue, Conradson, % (m/m), max.	—	—	—	12.0	14.0	20.0	22.0	22.0	22.0	—	—	—	—
Flash point, closed, Pensky-Martens, °C, min.	43.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Water content, % (V/V), max.	0.05	0.25	0.30	0.50	0.80	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sediment by extraction, % (m/m), max.	0.01	0.02	—	—	—	—	—	—	—	—	—	—	—
Ash, % (m/m), max.	0.01	0.01	0.05	0.10	0.10	0.15	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Sulphur content, % (m/m), max.	1.00	2.00	2.00	3.50	4.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Cloud point, °C max.	—16	—	—	—	—	—	—	—	—	—	—	—	—
Pour point, upper, * °C, max. (1 December — 31 March) (1 April — 30 November)	—	0 6	0 6	24 24	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30	30 30
Vanadium content, mg/kg, as V, max.	—	—	100	250	350	500	600	600	600	600	600	600	600

* The word "upper" does not apply to grades M2 and M3.

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